

CHAPTER 33

FIRE PROTECTION

33-1. Minimum maintenance activities for fire protection systems

The tables that follow indicate items that must be performed to maintain systems and equipment at a minimum level of operational readiness. The listed minimum action items should be supplemented by manufacturer recommended maintenance activities and procedures for specific pieces of equipment. Halon systems are being phased out or are already removed from service. Maintenance of these systems will not be addressed. Maintenance actions included in this section are for various modes of operation, subsystems, or components. Table 33-1 provides maintenance information for automatic sprinkler systems. Table 33-2 provides maintenance information for dry pipe sprinkler systems. Table 33-3 provides maintenance information for carbon dioxide systems. Table 33-4 provides maintenance information for detection and alarm systems.

33-2. General maintenance procedures for fire protection systems

Equipment maintenance is the responsibility of both operating and maintenance personnel. Many of the items required by this section are performed as an operator routinely monitors and logs the operation of the system. Some equipment maintenance listed in the tables at the end of this chapter indicates that the required action is to report the status of a system or device. In these cases, the defect or discrepancy that is found cannot be corrected or repaired during the routine inspection. The facility maintenance group must plan and schedule the required repair or correction. Finally, the facility operator should use the following as a guide in conjunction with the maintenance manuals for equipment installed at the facility to develop a comprehensive maintenance plan for the facility.

a. Facility review. Preventive maintenance of a sprinkler system includes periodic reviews of the protected area to ensure that no changes have occurred that would interfere with the fire protection efficiency of the system, such as the following.

- (1) Change of occupancy increasing the hazard beyond the original design criteria of the system.
- (2) Sprinkler heads that were inadvertently painted or received paint spots when the area was painted.
- (3) Change in storage arrangement that could affect the sprinkler discharge.
- (4) Control valves obscured by equipment or construction.
- (5) Sprinkler system equipment, devices, or heads damaged by vehicles or motorized equipment.
- (6) Sprinkler head discharge obstructed by new construction.
- (7) Shift in machinery or equipment that could damage the sprinkler heads.

b. Automatic sprinkler systems. Automatic sprinkler systems may be classified as “wet-pipe” or “dry-

pipe.” Wet-pipe systems are permanently piped water systems that use heat-actuated sprinkler heads to discharge water on a fire. Dry-pipe systems utilize heat-actuated sprinkler heads attached to a piping system containing air under pressure. When a sprinkler operates, the air pressure is reduced, a dry-pipe valve is opened by water pressure, and water flows to any opened sprinklers.

(1) Sprinkler heads that have been in service for 50 years must have representative samples removed and submitted to a testing laboratory that is acceptable to the authority having jurisdiction for operational testing, and this procedure should be repeated every 10 years. Sprinkler heads should be visually checked periodically for corrosion, paint, or damage. If any of these conditions are found, heads should be replaced.

(a) If changes in occupancy have changed the temperature in the protected area, the temperature rating of the existing sprinkler heads should be verified, and heads with too low a temperature rating should be replaced with higher temperature heads to accommodate the highest anticipated temperature. The addition of new machinery or equipment that is heat producing will require that the new maximum temperatures be obtained to determine if the temperature rating of the existing sprinkler heads is adequate. It may be necessary to provide a recording thermometer if the machinery is not operated continuously. This type of thermometer is similar to the medical thermometer that will record the highest temperature and remain at this reading until shaken down. Solder type sprinkler heads with a high temperature rating that are exposed to a periodic, or continuous, maximum allowable ambient temperature condition should be tested at least every five years. Remove approximately 1 percent of the heads on a system and submit them to a testing laboratory acceptable to the authority having jurisdiction for testing. Sprinkler heads that are exposed to a periodic, or continuous, maximum temperature condition can become weakened and the solder fusible element can fail. This is especially true of heads that are classified with an extra-high temperature rating, such as 365°F.

(b) Corrosion-resistant sprinklers installed in areas where the heads are subject to corrosive fumes or chemicals must be periodically checked to determine if the corrosion-proof material coating the head is intact and the head is not coated with foreign material. Any corrosion-proof head with the corrosion-proof material damaged must be replaced with a new corrosion-proof head. Attempts to salvage a damaged corrosion-proof head by recoating is prohibited.

(c) Replacement of heads found to be defective, damaged, or painted must be with new heads of the same temperature rating and position (upright or pendent), and if corrosion-proof with the same corrosion-proof coating, used heads shall not be acceptable.

(d) If the area protected with automatic sprinklers is to be painted, the sprinkler heads shall be covered with polyethylene or cellophane bags having a thickness of 0.003 inch or less, and bags shall be removed when painting is completed. Heads exposed to painting or spraying areas where they may collect overspray should be checked for collection of residue. The heads should be covered with the bags, and these coverings should be replaced or heads cleaned frequently. If not covered as described, the heads should be replaced annually.

(2) Sprinkler piping and hangers should be maintained in a good condition and free from mechanical injury. Sprinkler piping should be checked periodically to prevent the piping from being used to support ladders, stock, or other material. Where piping and hangers are installed in areas subject to a corrosive atmosphere, a protective coating that resists corrosion must be provided and the piping and hangers maintained in a proper condition. Broken or loose hangers should be replaced or refastened. When the age of a sprinkler system warrants, an internal examination of the piping should be made, and if corrosion or foreign material is found to be present, the system should be flushed. The flushing of a sprinkler system

requires the services of a sprinkler contractor with experienced workmen and the proper flushing equipment.

(3) The gauges on a wet pipe sprinkler system should be checked monthly to ensure that the system is under normal water supply pressure. Gauges on a dry pipe system (pre-action and deluge systems) should be checked weekly to ensure that the required air and water pressure is being maintained. All systems gauges should be checked with an inspector's gauge every five years. There should be a ¼-inch valve and plug on the gauge supply line to facilitate the installation of the inspector's gauge.

(a) On dry pipe systems, a leak rate which drops the system pressure by more than 10 psig (0.7 bar) per week requires immediate repair.

(b) Increase system pressure to 50 psig and locate leaks by scanning system with a sonic leak detector; painting joints and fittings with a glycerin and soap solution; or introducing wintergreen into the piping system. Alternatively, the system may be hydrostatically tested if there is no chance of freezing.

(4) All water flow alarm devices should be tested quarterly, weather permitting, and this is best accomplished by opening the inspector's test connection and discharging a flow equivalent to one sprinkler operating. When freezing weather does not permit the operation of the inspector's test connection discharging to the atmosphere on the building exterior wall, there is a bypass test connection on the trim of the alarm valve and dry pipe valve which may be used to test the alarm devices.

(5) The approach of freezing weather mandates the checking of all system drains and all piping that may contain water that is exposed to freezing conditions. The ½-inch automatic ball check drain on the fire department pumper line must be checked for proper operation. All drains on the dry pipe system must be checked to make certain that no condensation water has collected. Drum drip drains on the dry pipe systems must be emptied. It is expedient to check to make certain that windows, skylights, doors, ventilators, and other openings are not exposing wet sprinkler piping to freezing weather. This exercise should also include blind spaces, unused attics, stair towers, etc., which are subject to freezing temperatures. The low-point drains on a dry pipe system should be drained frequently to remove all moisture, and this process should be repeated daily until all condensate water has been positively removed.

(6) The air pressure on each dry pipe system should be checked at least once a week, and should be maintained at a pressure recommended by the dry pipe valve manufacturer. If there is leakage of air pressure exceeding 10 psi per week, repairs are mandated.

(7) Dry pipe valves should be trip-tested with the control valve wide open at least once every three years. This test is conducted by opening the inspector's test connection and the inspector's test run until it has been determined that the dry pipe valve has tripped and clean water is flowing from the inspector's test outlet. The dry pipe valve should be cleaned and parts renewed as required following this test, and the dry pipe valve should be reset. Use the following procedure to trip test dry pipe valves.

(a) With water supply shut off, trip test dry pipe valve and quick opening devices. During test, allow condensate to drain from system, and clean and maintain dry pipe valve as required. Reset valve and system.

(b) With water supply on, trip test system by opening inspector's test connection. Verify that appropriate alarms are activated as pressure is released and the flow of water is initiated.

(c) If water flow from inspector's test connection does not appear within 60 seconds, check

piping for closed valves or obstructions and excessive air pressure in system. If neither of the above, system should be evaluated for installation of an accelerator or an exhauster.

(d) Prior to initiating the wet trip test, flush the supply system by fully opening the main drain and allowing water to discharge at full pressure to clear any accumulations of scale or other foreign material. If a hydrant takes supply from the system main, flush hydrant before opening main drain.

(e) When wet trip is completed, thoroughly drain the system. Remove the dry pipe valve cover plate. Determine if valve operation was normal by position of parts. Thoroughly wash inside of valve body and wipe clappers with a clean cloth. Remove all dirt and scale with special attention to small valves or ports to drains and alarm devices. If rubber seats or rings are deformed, cracked, or in generally poor condition, replace with new parts.

(8) The air compressor should be kept clean and all filters cleaned as required, and crystals in air dryers should be replaced when the color changes indicating that they have absorbed moisture.

(9) The following are conditions that may indicate the need for investigation of the interior of the piping or valves.

(a) Discharge of obstructive material during routine water tests.

(b) Foreign material in dry pipe valves, alarm valves, check valves, and control valves.

(c) Heavy discoloration of water during drain tests or plugging of the inspector's test connection.

(d) Plugging of the sprinklers.

(e) Plugged piping in the sprinkler piping during alterations to the sprinkler system.

(f) Abnormally frequent tripping of the dry pipe valve.

(g) Dry pipe systems found obstructed should be flushed and re-examined at not more than five-year intervals.

(h) Where conditions are favorable, dry pipe systems should be examined at 10-year intervals after installation.

(10) All control valves, both interior and on underground mains, should be periodically operated and, if necessary, greased for ease of operation. Electric tamper switches should be tested during the opening and closing of control valves.

(11) Fire department pumper connections should be inspected monthly, and must remain unobstructed and visible. Caps or plugs should remain in place with threads in good working condition, check valve not leaking, and waterway visually free of foreign material. No new construction or equipment shall be installed in a position to limit the operation of the hose wrenches when attaching the 2 1/2-inch fire hose.

(12) All hose stations should be inspected at least monthly to verify that all equipment is in place and in good condition. Hose racks or reels and nozzles should be checked for visible signs of mechanical

damage or deterioration, and hose station control valves should be checked for signs of leakage.

(13) The sprinkler cabinet should be checked during system inspection to determine if the cabinet contains the required number of each type of sprinkler and temperature ratings that are used on the system. The sprinkler cabinet shall also contain at least one sprinkler wrench suitable for each type of sprinkler used on the system. Location of cabinets will minimize exposure to excessive moisture, dust, corrosion, or temperatures exceeding 100°F.

c. CO₂ extinguishing systems. CO₂ extinguishing systems use a limited stored supply of CO₂ under pressure, in conjunction with a permanently piped system of discharge nozzles, to totally flood an enclosed area. The agent, released automatically by a suitable detection system, extinguishes fires by reducing the oxygen content of air below combustion support. **Personnel must be evacuated before agent discharge to avoid suffocation.**

(1) A manufacturer's test and maintenance program should be instituted, and at least annually, all carbon dioxide systems should be thoroughly inspected and tested for proper operation by competent personnel. The goal of this inspection and testing should be to not only ensure that the system is in full operating condition, but also indicate the continuance of that condition until the next inspection. An inspection report with recommendations must be submitted to the owner. Between regular service contract inspections or tests, the system shall be inspected visually by competent personnel. Weight and the date of the last hydrostatic test shall be noted.

(2) At least semiannually, all high-pressure carbon dioxide cylinders shall be weighed and the date of the last hydrostatic test shall be noted. If a CO₂ container shows a loss in net content of more than 10 percent, the cylinder shall be refilled or replaced.

(3) Weekly, the liquid level gauges of low-pressure CO₂ containers shall be observed. If a container shows a loss of more than 10 percent, it shall be refilled.

(4) All system hoses, including those used as flexible connectors on carbon dioxide systems, shall be examined annually for damage. If visual inspection indicates any deficiency, the hose shall be replaced or tested at 2,500 psi for high-pressure systems and 900 psi for low-pressure CO₂ systems. All hose systems, including those used as flexible connectors, shall be tested every five years.

(5) Carbon dioxide system detection and alarm systems shall be tested at least annually. All detectors shall be cleaned in a manner prescribed by the manufacturer at least annually. Ionization detectors may require cleaning more frequently if installed in an atmosphere subject to dust. Manufacturer's recommendations shall be followed for testing, cleaning, and maintenance of detection and alarm systems.

d. Detection and alarm systems. Preventive maintenance of fire detection and alarm systems is essential to ensuring automatic fire suppression systems operate properly when needed.

(1) Manual alarm initiating devices encountered in a facility may include non-coded and coded manual pull stations; pre-signal and general alarm stations; breakglass and non-breakglass stations; single and double action stations; key operated manual stations; and addressable manual stations. The function of each should be tested in accordance with manufacturer's recommendations to verify that operation of the device sends the proper signals to alarm and system actuation devices.

(2) Heat detectors are generally located on or near the ceiling and actuate as a result of the convected thermal energy of a fire. They respond either to a specified rate of temperature change, or when the detecting element reaches a predetermined fixed temperature.

(a) Fixed temperature, non-restorable, line type units shall be mechanically and electrically tested to verify operation. Measure and record loop resistance of line type detectors and compare with original acceptance test values.

(b) Fixed temperature, non-restorable spot type detectors shall be laboratory tested for function. Submit two units per 100 installed to a recognized testing laboratory. Replace submitted units with new units of same type and rating. Follow laboratory recommendations for additional maintenance and replacement.

(c) Fixed temperature and/or rate-of-rise and rate compensation restorable line or spot type detectors (not pneumatic tube) shall be tested with heat source such as a hair dryer or shielded heat lamp. Testing only 10 percent of the units at each test cycle is required. Plan testing so that all units are tested over any five-year span. Avoid damage to non-restorable fixed temperature element of combination rate-of-rise and fixed temperature detectors.

(d) Pneumatic tube restorable line type detectors shall be tested with a heat source.

(3) Verify function of smoke detectors by calibrated test method using manufacturer's calibrated sensitivity instrument. Ordinary pressurized test aerosols, or smoke from cigarettes or similar sources shall not constitute a test.

(4) Post indicator valve and gate valve tamper switches shall be tested by operating the valve and verifying that the proper trouble signal is activated.

(5) Low air pressure device on dry pipe and supervised pre-action systems shall be tested for transmission of appropriate trouble signal.

(6) Using system test features, verify proper operation of audible and visual alarms.

(7) Using system test features, verify operation of all lamps and light-emitting diodes (LEDs). Remove and inspect fuses and verify fuse rating.

(8) Test main power supply by disconnecting all secondary (standby) power and test under maximum load, including all alarm appliances operating for five minutes.

(9) Test secondary (standby) power supply by disconnecting all primary power supplies. Verify that required trouble indication for loss of primary power is operational. Measure system's standby current and compare with manufacturer's data for determining whether batteries are adequate to meet standby requirements. Test under maximum load, including all alarm devices operating for five minutes. Reconnect primary (main) power supply at end of test.

(10) Sealed lead acid batteries are not vented since the gas evolved during recharging is internally recombined. A high pressure vent is provided to avoid damage during abnormal conditions. Typical maintenance activities include the following.

(a) Check open-circuit voltage. Measure battery voltage under full load conditions with battery charger disconnected. Clean all connections. Check operation of battery charger.

(b) Replace batteries as required.

(11) Although traditional wet-cell vented lead acid batteries require more maintenance than sealed battery systems, they are still used in applications with relatively high current drain requirements. Typical maintenance activities include the following.

(a) Visually inspect electrolyte level and connections. Add electrolyte and clean connections as required.

(b) Measure open-circuit voltage.

(c) Measure specific gravity.

(d) Measure battery voltage under full load conditions with battery charger disconnected. Clean and coat battery connections. Check open-circuit voltage. Check operation of battery when recharged battery voltage or specific gravity falls below manufacturer recommendations.

(12) Nickel-cadmium batteries are generally used where current drain during a primary power outage is low to moderate. Typical maintenance activities include the following.

(a) Measure open-circuit battery voltage. Clean and inspect battery connections.

(b) Measure output voltage and current of battery charger. Measure battery voltage under full load conditions with battery charger disconnected. Check operation of battery charger. Replace battery when recharged battery voltage or current falls below manufacturer's recommendations.

(13) Verify operation of panel trouble signals and ring-back feature for systems using a trouble silencing switch which requires resetting.

Table 33-1. Automatic sprinkler systems

Automatic Sprinkler Systems	
<i>Action</i>	<i>Frequency</i>
Control Valves	
Check sealed valves to verify valve is sealed in open position and seal is unbroken	week
Check locked valves and valves equipped with electric tamper switches to verify valve is open, and lock is not broken or tamper switch is not damaged.	mo
Lubricate valve stems, and exercise valves to verify operation and distribute lubrication.	yr
Post Indicator Valve	
Exercise valves. Open until spring or torsion is felt in the rod and back-off one quarter turn from wide open position to prevent jamming.	3 mos
Underground Gate Valves with Roadway Boxes	
Exercise valves. Operate each valve using a T-handle wrench to verify valve is in proper position.	3 mos
Verify roadway box is readily accessible and that cover is in place.	3 mos
Verify that installed signs are not obstructed and that information is legible	3 mos
Fire Department Pumper Connection	
Verify that connection is both visible and accessible at all times.	mo
Verify that all caps and plugs are in place and threads are in good condition. Remove caps and plugs and verify that waterway is free of all foreign material. The presence of water indicates check valve may be leaking and/or ball drip may not be functioning properly.	mo
Verify that ball drip or drain is in working order.	mo
Inspect for leakage into piping beyond check valve. Continual drip from ball drip or drain is indication that check valve may be leaking.	mo
Sprinkler	
Inspect area protected by sprinkler system for the following:	
Any changes in use which require higher temperature rating sprinklers.	mo
Piled material stocks are at least 18 inches below sprinkler heads.	mo
No new construction or equipment is blocking heads.	mo
Clean sprinkler heads protected by a polyethylene or cellophane bag (0.003 inch thickness or less) and replace protective bags.	mo
Inspect all sprinkler heads for the following:	

Table 33-1. Automatic sprinkler systems (continued)

Automatic Sprinkler Systems	
<i>Action</i>	<i>Frequency</i>
Corrosion – If due to normal aging, replace with new head of same type and rating. If due to operation in area emitting corrosive vapors, replace with factory-applied lead or wax-coated corrosion resistant heads.	3 mos
Paint or similar coating applied to head in field – Replace head.	3 mos
Light corrosion, dirt, or other foreign material – clean head to like new condition, or replace head as required.	3 mos
Head guards for accessible sprinklers are in place and any sprinkler showing evidence of mechanical damage is replaced.	3 mos
Inspect spare sprinkler cabinet	
Replace heads that have been removed.	3 mos
Verify that sprinkler wrench is present.	3 mos
Verify that cabinet contains at least one replacement head for each size, type, and rating of head used in the facility.	3 mos
Verify that temperature where cabinet is located does not exceed 100°F (38°C).	3 mos
For sprinklers with fusible links protecting commercial type cooking equipment and associated ventilation systems:	
Inspect and clean, and replace as required.	6 mos
Replace.	yr
Replace sprinklers protecting spraying areas where the heads are not protected by polyethylene or cellophane bags.	yr
Test a representative sample of all solder type sprinkler heads with a temperature rating of extra high (325°F or 163°C). Testing shall be by an approved testing laboratory. Minimum sample is four per riser or 1 percent of the total heads, whichever is greater. Follow laboratory recommendation for additional maintenance or replacement.	5yr
Test a representative sample of all sprinklers every 10 years.	10 yrs ¹
Hangers	
Visually inspect system for broken or loose hangers, and repair or replace as required.	3 mos
Piping	
Visually inspect piping for:	
Mechanical injury. Repair or replace as required.	3 mos

Table 33-1. Automatic sprinkler systems (continued)

Automatic Sprinkler Systems	
<i>Action</i>	<i>Frequency</i>
Piping being used to support equipment or devices (ladders, other pipes, conduit, clothing, etc.) which are not part of system. Eliminate condition immediately.	3 mos
Gauges	
Check system pressure.	mo
Remove gauge and verify pressure with test gauge. Service and replace gauge.	5 yrs
Alarms	
Test alarms in nonfreezing weather by opening inspector's test connection to provide flow equivalent to one sprinkler head.	3 mos
Test alarms in freezing weather, by opening by-pass test connection on alarm valve.	3 mos
Water Motor Alarm	
Test alarm in nonfreezing weather by opening inspector's test connection to provide actual flow.	3 mos
In freezing weather, do not flow test. Verify by inspection that parts are free and drain is not clogged.	3 mos
Supply Test	
Open main drain valve and note pressure gauge readings when full flow is obtained. Compare reading with reading before opening valve and with previous readings when system was flow tested. Variations in readings may indicate closed valves or obstructions in supply pipe.	3 mos
Freeze Prevention	
Inspect system to verify that windows, skylights, doors, ventilators, or other openings and closures will not unduly expose sprinkler piping to freezing. Blind spaces, unused attics, stair towers, and concealed spaces shall be inspected and action taken as required to prevent freezing temperatures from occurring.	

¹ After 50 years in service.

Table 33-2. Dry pipe sprinkler systems

Dry Pipe Sprinkler Systems	
<i>Action</i>	<i>Frequency</i>
Dry Pipe Valve	
Check priming water level by use of the priming water level test valve to maintain level required by the manufacturer.	3 mos
Trip test system	yr
Supply Water Flow Test	
Open main drain and allow water to flow for a short period of time to ensure water supply to system is available.	3 mos
Low Air Alarm	
Test low air alarm for proper function.	3 mos
Pressure Gauges	
Observe system pressure gauge(s) to ensure recommended pressure is being maintained.	week
Dry Pipe Valve Enclosure	
Inspect to ensure that the thermostatic heater system is functioning properly and maintaining a temperature in the enclosure of not less than 40°F (4°C).	week ¹
Water Flow Alarms	
Using alarm test by-pass, test water flow alarms – pressure switch and water motor alarm. Do not test water motor alarm in freezing weather.	3 mos
Auxiliary Drains	
Drain water from all low point drains:	
As freezing weather approaches and first few days of freezing weather.	day
During freezing weather.	week
Pipe Pitch	
Inspect piping to detect low points which may trap water. Verify pitch with spirit level as required.	yr ²
Intermediate Chamber Drain	
Inspect intermediate chamber drain to verify free operation of drain assembly.	mo
Air Compressor	
Inspect compressor for the following:	

¹ During freezing season² After trip test and before freezing weather.

Table 33-2. Dry pipe sprinkler systems (continued)

Dry Pipe Sprinkler Systems	
<i>Action</i>	<i>Frequency</i>
Clean dirt from motor.	3 mos
Clean or replace filters and strainers as required.	3 mos
Replace desiccant if required (change in color of desiccant).	3 mos
Air Maintenance Device	
Inspect and clean strainers, filters, and restriction orifices. If drain cock provided, drain condensation	3 mos
Quick-Opening Devices (Accelerator/Exhauster)	
Test quick opening devices in accordance with the manufacturer's instructions. If device does not test properly, immediately replace the device with a new unit.	6 mos

Table 33-3. Carbon dioxide systems

Carbon Dioxide Systems	
<i>Action</i>	<i>Frequency</i>
Low Pressure System	
Check and record storage tank level. Loss in net content of more than 10 percent mandates refilling, unless minimum requirements for primary and reserve supply are still available in the container.	week
Inspect valve packing glands, screwed connections, safety relief valves, and similar piping components for leaks and repair as required.	mo
Maintain tank refrigeration equipment in accordance with manufacturer's recommendations.	per mfg
Test operation of tank alarm pressure switch and operation of alarm bell and/or light by decreasing and increasing the system pressure. Pressure may be reduced by closing the valve in the line from the vapor space and removing the test plug. Pressure may be increased by connecting a high-pressure cylinder to the test opening. At completion of testing, test plug shall be carefully replaced and vapor line valve reopened.	6 mos
Check liquid level and tank pressure gauges for accuracy.	yr
Replace storage tank frangible disks.	5 yrs
High Pressure System	
Weigh and record weight of all high pressure cylinders. If cylinder weight indicates a net content loss of 10 percent, it shall be replaced.	6 mos
Inspect all system hoses and components associated with connecting hoses such as flexible connectors for damage. Replace any hose or component showing evidence of any damage or deficiency.	yr
Inspect all cylinder brackets and supports. Replace any bracket or support component showing evidence of any damage or deficiency.	yr
Pressure test all system hoses and components associated with connecting hoses such as flexible connectors. Testing shall be performed by a recognized testing organization using equipment and procedures in accordance with NFPA requirements.	5 yrs
Piping – High and Low Pressure Systems	
Inspect piping for evidence of corrosion. Piping showing severe corrosion shall be replaced.	yr
Nozzles – High and Low Pressure Systems	
All nozzles shall be examined to verify that orifices are clear and unobstructed. Any nozzle that is obstructed or plugged by corrosion or foreign material that cannot be cleaned to like new condition shall be replaced with a new nozzle of the same type and orifice size.	yr

Table 33-3. Carbon dioxide systems (continued)

Carbon Dioxide Systems	
<i>Action</i>	<i>Frequency</i>
Check nozzles for proper position and alignment.	yr
For sealed unit nozzles, inspect seal for any sign of deterioration. Replace any nozzle where wear shows evidence of any damage, deterioration, or other deficiency	yr
Detectors	
All detectors shall be individually inspected for corrosion or foreign material. If detector cannot be cleaned to like new condition, replace detector.	yr
Detection System	
Verify operation of detection system control and alarm functions in accordance with the manufacturer's recommendations.	yr
Detection and Actuating Systems	
Verify operation of automatic system actuation controls and devices. Remove automatic actuating controls from cylinders. Simulate a fire condition at each detector and observe that actuating control devices move to the "discharge" position.	yr
System Operating Devices	
Verify operation of manual system actuation controls and devices. With automatic actuating controls deactivated, operate each manual system operating device (manual Pull stations, switches, abort switches, etc.) and observe that the actuating controls move to the "discharge" position.	yr
Total Flood System Time Delay	
With the automatic actuating controls deactivated, operate the time delay device. Also check that the timer will complete its cycle even though wiring between time and detector circuit is interrupted. Check time limit.	yr
Alarm System	
During simulated fire activation of detectors with automatic system actuating controls deactivated, verify function of all alarm devices including transmission of remote alarm signals.	yr
Auxiliary Equipment	
During simulated fire activation of detectors with automatic system actuating controls deactivated, verify proper operation of all magnetic door holders, window releases, HVAC unit interlocks, damper releases, operation of interlocked valves and solenoids, and supplementary alarms.	yr
Power Supply	
Inspect wiring, circuit breakers, fuses, disconnects, and similar electrical components and replace any damaged components or components which do not properly operate.	yr

Table 33-3. Carbon dioxide systems (continued)

Carbon Dioxide Systems	
<i>Action</i>	<i>Frequency</i>
Check condition of emergency power supply (battery condition) and operation of battery charger. Verify operation of automatic switch over from main electric service to battery backup.	yr
Selector Valves	
Exercise all selector (directional) valves. Reset to proper position when exercise completed.	yr
Signs	
Check to determine that all warning signs are properly displayed, and all manual pull station functions are clearly indicated.	mo
Explosive Release Devices	
Inspect condition of charges and expiration of charge. Replace charge prior to expiration date.	3 mos
System Integrity	
Visually inspect protected area for changes (construction configuration, change in occupancy, change in hazard, addition of equipment, etc.) that could affect original design criteria or carbon dioxide concentration.	yr
Visually check for changes in protected area that could affect efficiency of detectors or nozzle discharge.	yr
Visually check protected area to identify doors blocked in open position, and unclosable openings in walls, floors, and ceilings. Initiate corrective action immediately.	yr

Table 33-4. Detection and alarm systems

Detection and Alarm Systems	
<i>Action</i>	<i>Frequency</i>
Manual Pull Stations – With/Without Break Glass	
Test function in accordance with manufacturer's recommendations. Verify that operation of switch sends proper signals to alarm and system actuation devices.	6 mos
Double Action Manual Stations	
Test function in accordance with manufacturer's recommendations. Verify that operation of switch sends proper signals to alarm and system actuation devices.	6 mos
Key Operated Manual Stations	
Test function in accordance with manufacturer's recommendations. Verify that operation of switch sends proper signals to alarm and system actuation devices.	6 mos
Key Operated Pre-Signal Manual Stations	
Test function in accordance with manufacturer's recommendations to verify activation of pre-signal alarm.	6 mos
Test function in accordance with manufacturer's recommendations to verify general alarm signal and system actuation signal.	yr
Coded Manual Stations	
Test function in accordance with manufacturer's recommendations. Verify that operation of switch sends proper signals to alarm and system actuation devices.	6 mos
Addressable Manual Stations	
Test function in accordance with manufacturer's recommendations. Verify that operation of switch sends proper signals to alarm and system actuation devices.	6 mos
Heat Detectors	
Fixed temperature, non-restorable, line type units shall be mechanically and electrically tested to verify operation. Measure and record loop resistance of line type detectors and compare with original acceptance test values.	6 mos
Fixed temperature, non-restorable spot type detectors shall be laboratory tested for function. Submit two units per 100 installed to a recognized testing laboratory. Replace submitted units with new units of same type and rating. Follow laboratory recommendations for additional maintenance and replacement.	5 yrs
Fixed temperature and/or rate-of-rise or rate compensation restorable line or spot type detectors (not pneumatic tube) shall be tested with heat source such as a hair dryer or shielded heat lamp. Testing only 10 percent of the units at each test cycle is required. Plan testing so that all units are tested over any five-year span. Avoid damage to nonrestorable fixed temperature element of combination rate-of-rise and fixed temperature detectors.	6 mos

Table 33-4. Detection and alarm systems (continued)

Detection and Alarm Systems	
<i>Action</i>	<i>Frequency</i>
Pneumatic tube restorable line type detectors shall be tested with a heat source.	6 mos
Smoke Detectors	
Verify function by calibrated test method using manufacturer's calibrated sensitivity instrument. Ordinary pressurized test aerosols, smoke from cigarettes or similar sources shall not constitute a test.	yr
Valve Tamper Switch	
Post indicator valve and gate valve tamper switches shall be tested by operating the valve and verifying that the proper trouble signal is activated.	6 mos
Low Air Pressure Alarm	
Low air pressure device on dry pipe and supervised pre-action systems shall be tested for transmission of appropriate trouble signal.	6 mos
Low Temperature Alarm	
Low temperature alarm device shall be tested to activate the appropriate trouble signal should the temperature drop below a predetermined point.	6 mos
Audible and Visual Alarms	
Using system test features, verify proper operation of audible and visual alarms.	yr
Control Panel	
Using system test features, verify operation of all lamps and LEDs. Remove and inspect fuses and verify fuse rating.	yr
Primary Main Power Supply	
Test main power supply by disconnecting all secondary (standby) power and test under maximum load, including all alarm appliances operating for five minutes.	yr
Secondary (Standby) Power Supply	
Test secondary power supply by disconnecting all primary power supplies. Verify that required trouble indication for loss of primary power is operational. Measure system's standby current and compare with manufacturer's data for determining whether batteries are adequate to meet standby requirements. Test under maximum load, including all alarm devices operating for five minutes. Reconnect primary (main) power supply at end of test.	yr
Sealed Lead Acid Batteries	
Check open-circuit voltage. Measure battery voltage under full load conditions with battery charger disconnected. Clean all connections. Check operation of battery charger.	yr

Table 33-4. Detection and alarm systems (continued)

Detection and Alarm Svstems	
<i>Action</i>	<i>Frequency</i>
Replace batteries.	4 yrs
Lead Acid Batteries	
Visually inspect electrolyte level and connections. Add electrolyte and clean connections as required.	week
Measure open-circuit voltage.	6 mos
Measure specific gravity.	6 mos
Measure battery voltage under full load conditions with battery charger disconnected. Clean and coat battery connections. Check open-circuit voltage. Check operation of battery when recharged battery voltage or specific gravity falls below manufacturer recommendations.	yr
Nickel-Cadmium Batteries	
Measure open-circuit battery voltage. Clean and inspect battery connections.	3 mos
Measure output voltage and current of battery charger. Measure battery voltage under full load conditions with battery charger disconnected. Check operation of battery charger. Replace battery when recharged batter voltage or current falls below manufacturer's recommendations.	yr
Trouble Signals	
Verify operation of panel trouble signals and ring back feature for systems using a trouble silencing switch which required resetting.	yr